"Framework for Estimating Uncertainty of ADCP Measurements from a Moving Boat by Standardized Uncertainty Analysis"

Editorial Revisions:

As marked on the attached pages, except for the second item, all the comments on all the editorial review list have been addressed as requested. We could not address the second item as requested in the checklist because only (1) Open-channel flow, (2) River flow, and (3) Flow measurement were found in the **CE Database Subject Headings**. Subject headings: (4) Hydrometry, (5) Acoustic Doppler Current Profilers, (6) Standardized uncertainty analysis, (7) ADCP elemental errors, and (8) ADCP measurement uncertainty are not included.

Review Summary from Associate Special Editor

Three reviews have been obtained for this paper. All reviews were very positive. The paper is very well organized and logical in its presentation of uncertainty associated with ADCP measurements. The authors provide details to orient the reader but then focus on the relevant topics for the balance of the paper. You are to be congratulated for treating this topic and providing one of the first systematic analyses of uncertainty for ADCP measurements.

The paper appears to greatly exceed the 10,000 word limit for a technical paper. The paper appears to be written in a report format or for a book because it is organized with numbers in the heading (note heading 4.1 is repeated). One of the reviewers believes that the readers might get lost in this over-length paper.

With regards to the paper length, I recommend that the authors break the paper into 2 parts. The first part should contain the background information on ADCPs and UA. While part 2 would include the remainder of the paper includes quantitative analyses. I would also encourage the authors to follow the suggestions of Reviewer C and shorten the paper by deleting nonessential sections. I am not sure how the Journal publishers feel about appendices, but I would think they may not be warranted in this case, especially Appendices A and B. Perhaps the main points in the appendices can be inserted in the body of the paper in an abbreviated form.

The authors should look at the review comments carefully and incorporate changes into the manuscript. In order to expedite the next review, the authors should create a table which lists the reviewers' comments and how they address the comments by each reviewer.

1. We have addressed the paper length to keep it as close as possible to the standard size.
2. We removed numbering from the headings.
3. We have followed the latest recommendation of keeping the paper short in a single paper, as opposed to the associate special editor recommendation of splitting the paper into two.
4. Due to the latest recommendation of not dividing the paper and observing the recommendations of reviewer C, we took out non-essential parts and condensed the analytical part as much as possible without jeopardizing the clarity in presenting the ADCP UA framework.
5. To maintain clarity, we combining and condensing appendices A and B in the original manuscript into a single appendix. We also think that it is very important to include appendix B because it presents material essential for introducing and applying the framework.
6. The last review comment regarding a list of the reviewers' comments and how we addressed each of them is given below.

Comments from Reviewer A.

.Suggest list of acronyms e.g. UA, ASME, DRE, GPS, RDI
page 8 after reference Coleman and Steele add a second reference from list ISO 1993 from page 36
page 9 first line after summation of add "(see Fig 2)"
page 10 five lines from top change fig 2 to fig 3
page 23 para 2 line 5 delete "is"
page 23 para 2 last sentence – simplify
page 23 last para last line insert "is" between bias and the boat
page 24 para 2 cell mapping error - water mode 11- explain. also para 2 last 2 sentences combine or simplify ? para 3 line 3 read "through" for "thought" also para 3 last sentence- is it "errors in compass calibration bias" or "errors in calibration"
page 25 para 4 suggest add reference after Pelletier, 1988- "ISO 2006" (this reference is ISO1088. Hydrometry; Velocity Area Methods Collection and Processing of data for the determination of uncertainties in flow measurement.)
page 26 second last line on page read Table 3 not Table 4 page 33 last para line 2 suggest "involved"

1. List of acronyms are not customary; we have use the standard approach of introducing acronyms right after the spelled out text when they first appear in the text.
2. Former p. 8; reference has been added to text in page 8 (see p.9 in current version).
3. Former p. 9; "(see Fig. 2). has been added (see p. 10 in current version).
4. Former p. 10; Fig. 2 has been changed to Fig. 3 (see p. 11 in current version).
5. Former p. 23; Text has been revised (see p. 20 in current version).
6. Former p. 23; Text has been revised (see p. 20 in current version).
7. Former p. 23; Text has been revised (see p. 21 in current version).
8. Former p. 24; Water modes are described in RDI's manuals. Text has been changed from "water mode 11" to "RDI's water mode 11" (see p. 22 in current version).
9. Former p. 24; Text in paragraph 2, last 2 sentences has been simplified (see p. 22 in current version).
10. Former p. 24; Text in paragraph 3, line 3 sentences has been changed from "thought" to " through" (see p. 22 in current version).
11. Former p. 24; Text in paragraph 3, last sentence has been changed to "errors in calibrating the compass bias" (see p. 22 in current version).
12. Former p. 25; ISO1088 Reference has been added as suggested (see p. 23 in current text).
13. Former p. 26; second to last line "Table 4" has been changed to "Table 2." Former Table numbering has changed in the current version. (see p. 24 in current text).
14. Former p. 33; Last par., line 2, Text has been condensed as recommended by Reviewer C. Comment does not apply to current version (see p. 30 in current version).

Comments from Reviewer B

This is a well-written and organized paper on a very complex topic. It does a good job of presenting detailed information and then summarizing the essential and relevant aspects based on the current state of the practice in this field. I noted only a few editorial improvements that could be made.

Page 3 – near end of paragraph beginning "Pressed by the need...", the discussion of similarities and differences of ISO, AIAA, and ASME standards is worded in an awkward way. Suggest "The three standards rely on the same statistical principles..." "The differences are in terminology and implementation procedures. The ISO standard classifies errors based on the approach used to evaluate them, while the AIAA and ASME standards use the traditional engineering approach of classifying errors based on how they affect the result."

Page 4 – Move words "we developed". "In section 5, we describe the analytical framework we developed for UA of ADCP discharge measurements from a moving boat and show how it allows us to propagate the uncertainties from the elemental sources of quantities measured or calculated by ADCPs into the total uncertainty of the measured discharge."

Page 4 – paragraph at bottom of page introducing terminology could be better organized.

Page 5 – paragraph between eq. 1 and eq. 2 is confusing. It tells what the term "test" is not, but doesn't tell what it is.

1. Former p. 3; text has been changed to "The differences are in terminology and implementation procedures; the ISO standard classifies errors based on the approach to evaluate them, while the AIAA and ANSI/ASME standards use the traditional engineering approach of classifying errors based on how they affect the result." (see p. 4 in current version)
2. Former p. 4; text has been moved as suggested (see p. 5 in current version)
3. Former p. 4; paragraph at page bottom has been reorganized (see p. 5. in current version)
4. Former p. 5; paragraph between Eq. 1 and Eq. 2 has been rewritten fro clarity (see p. 5 in current version).

Comments from Reviewer C

1) The first comment is associated with the length of the paper. I do not know if the special issue will have a limit in terms of number of words. If so, this paper largely exceeds usual limits of ASCE papers of about 10,000 words. The Authors should reduce the length of the paper by eliminating some descriptions that can be read elsewhere. In fact, some ideas can be explained with a smaller number of words. Some paragraphs, like the last paragraph on page 26, or paragraphs in the conclusions, can be reduced or eliminated. The discussion on the data reduction equations of pages 5 and 6 could be significantly reduced. Further, I suggest defining what these equations are and including a reference for further reading. The discussion on the sources of errors could be also reduced (they take more than 6 pages). Besides fulfilling ASCE's page limit, reducing the length of the paper will benefit in having a more "compact" and readable paper.
2) I suggest having a 3D view of the overall measuring device in addition to the existing schematic in Figure 3, naming the two parts as a) and b). This will clarify significantly the location and orientation of the vectors in space.
3) A definition of "bottom tracking velocities" should be provided on page 11, to keep the rigor in previous definitions. There is a repetition of "or other external devices" in the third paragraph of page 11. I also suggest defining DGPS in that page.
4) When first presented in pages 11 and 12, it is not clear what the indices i and j mean in equations 14.a and b (they become clear later). In eq. 14.a, it should read F_D_b1, F_D_b2, etc. (it is only F_D_b1).
5) In the explanations of pages 16 and 17, it is not clear what is already known in terms of all those definitions and what are the Authors' contributions.
6) Concepts that are known or published elsewhere regarding the sources of error should be minimized, focusing only on those concepts that are novel, or are contributions by the Authors.
7) The Authors should provide an example to see how these ideas can be applied to a real case. I think this would be very important for the sake of addressing the feasibility of this framework.

"Framework for Estimating Uncertainty of ADCP Measurements from a Moving Boat by Standardized Uncertainty Analysis"

1. The paper has been revised to reduce its length as recommended by the reviewer. We have taken out as much as we think is possible without jeopardizing the paper clarity. The section presenting the DREs has been condensed, so has been the conclusions and the discussion of errors.

2. A 3D view of a boat-mounted ADCP has been added as Fig. 3a.

3.
   a. A definition of bottom tracking has been added in p. 11 of current version
   b. Text has been revised (see p. 12 in current version)
   c. DGPS is defined in p. 11 of current version

4.
   a. Indices *i* and *j* have been defined where they first appear.
   b. Eq. 14a has been corrected (see Eq. 15a) in current version. Please note that numbers have change due to restructuring of this section.

5.
   a. The revised text makes it clear that we are using the RDI algorithms as DRE's.

6. The section in identification of errors has been revised to make it concise. We have listed all the known sources of error in the context of UA as well as to introduce novel issues that in the authors' opinion require further attention.

7. We agree with the reviewer that illustrating the UA framework through an application is of great practical value; however, we believe that such an illustration should be done in a very detailed manner. The original recommendation of the guest editor about splitting the paper into two would have given us room for including a meaningful application example. Nevertheless, the last recommendation made later by the guest editors and the senior editor of condensing the paper and keeping in a single paper does not leave us enough room for an adding an example. On the contrary, even after condensing the original manuscript as advised by the reviewer, adding an example would substantially lengthen the paper. Fortunately, we strongly believe that an example would add very little to the motivation, scope, and goal of the present manuscript. In a later paper, we will address the implementation of UA of ADCP measurements from a moving boat, present a compilation of bias limit information and illustrate through example the advantage and benefits of the proposed UA framework.

Minor corrections

1) Page 3, line 14: Add "the" before "American Society..."
2) Page 4, line 27: Change "standard deviation" by "variance."
3) Page 11, last paragraph: please use "relations" instead of "relationships."
4) Page 17: Change "ADCP's..." by "ADCPs..." This is also a problem detected on page 43 in the last line.
5) Page 25: Eliminate comma after "Barenblatt (1993)"
6) Page 26: Begin section 4.1 with "A summary..." In the last sentence of that page: "...Table 4 indicates a possible way..." The "a" is missing.

1. Page 3; "the" has been added.
2. Text has been revised and reworded (see p. 5 in current version).
3. We revised this paragraph (see p. 13 in current version).
4. Text has been revised throughout to insure that ADCP's is used as possessive.
5. Text has been revised. (see p. 25)
6. Text has been modified from "indicates possible way" to "indicates possible ways." (see p.24 in current version).